CFCs and HALONS in NOVA SCOTIA

-A Use Analysis Study-
with
Recommendations For Control Options

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PART ONE

Introduction

The Nova Scotia Ozone Layer Protection Act is one of a number of statutory responses by provincial and municipal governments in Canada initiated, and designed to help implement Canada's obligations to the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer.

The Montreal Protocol is the first ever science-driven, international environmental control strategy. It was developed specifically in recognition that ozone layer depletion was caused by stratospheric infiltration of CFCs and Halons. This, together with the concomitant adverse impact of CFCs on climate change, and by the sheer weight of evidence to date, has forced world leaders to acknowledge that the CFC problem is a global problem requiring global solutions.

Nova Scotia's legislative response to this global challenge, the Ozone Layer Protection Act, is a unique, and possibly unprecedented, approach for coping with the CFC issue in Canada.

Unlike the regulatory responses in Ontario and British Columbia, for example, where stringent amendments to existing environmental protection acts were passed to restrict and control the manufacture, sale, etc. of CFCs and Halons, Nova Scotia has chosen to pass a new law, enabling the government to undertake a broad range of measures to protect the global atmospheric commons from abuses by Nova Scotians. The special importance of this piece of environmental legislation, is its unequivocal expression of the responsibility placed upon Nova Scotian's to "Think Globally, and Act Locally".

However, because the Ozone Layer Protection Act is only enabling legislation, it will depend upon the development and implementation of regulations for it to achieve its full potential.

This study, therefore, has been commissioned to develop the necessary background information needed for the preparation of regulations for the control of the chlorofluorocarbon (CFC) and

bromofluorocarbon (Halon) groups of substances, currently recommended for control under the Montreal Protocol, and to suggest other appropriate mechanisms,.or control strategies.

This report will present a detailed summery of the results of a survey of industrial and commercial users of CFCs and Halons in Nova Scotia, assess the potential impact on the industrial sector of restricting the use of CFCs and Halons, and will make recommendations on available control options.

I.0 The Survey

I.1) Method

Initially the project surveyed a number of manufacturers listed under industrial classifications in the Nova Scotia Directory of Manufacturers 1988-89, which corresponded to known products produced with, or containing CFCs. A "long list" was first established which included even those who may have been only remotely involved with CFC usage. Both random and strategic phone calls were then made to a number of firms on this list to clarify uncertainties so, by a process of elimination, a short list evolved. (see appendix "C"). Other sources also aided in the refinement of the list, including Environment Canada, industry contacts, and the Friends of the Earth Ozone Project, etc.

The survey formats -one for CFCs, the other for Halons- (see appendix A & B) were adapted, (with permission) directly from a concurrent national CFC/Halon survey being conducted by the Commercial Chemicals Branch of the Environmental Protection Service, Ottawa under a notice of CEPA, and each was modified slightly to relate specifically to the provincial context. These surveys were designed to assemble critical data on the types, volumes, import and export, distribution, recapture, and use of CFCs and Halons in Nova Scotia which have been scheduled for controlled reduction by the 1987 "Montreal Protocol on Substances that Deplete the Ozone Layer."

These include:

Table 1

Substance		ODP	Atmospheric Lifetime
-CFC-11	trichlorofluoromethane	1.0	75 yrs.
-CFC-12	dichlorodifluoromethane	1.0	111 yrs.
-CFC-113	trichlorotrifluoroethane	0.8	90 yrs
-CFC-114	dichlorotetrafluoroethane	1.0	185 yrs.
-CFC-115	chloropentafluoroethane	0.6	380 yrs.
-Halon-1211	bromochlordifluoromethane	3.0	25 yrs.
-Halon-1301	bromotrifluoromethane	10.0	110 yrs.
-Halon-2402	dibromotetrafluoroethane	6.0	n/a

There was close to a 20% rate of return on the survey mail out (28 of 145), which by usual standards is over twice the expected rate of return. About 43% (12 of 28), responded either to declined the request for information, or to report no use of CFCs or CFC based products.

The data acquired from the remaining 16 firms however proved to be somewhat problematic because of the relatively small "window" each return provided to the overall view of potential use of CFCs in the 6-8 different use application areas being studied. In order to fill out the picture, an additional 50 to 60 phone calls and personal visits were made to firms late in the project to secure either specific and general information. These were limited mostly to the rigid foam, refrigerants, and solvents use application areas.

I.2) Base Lines

Estimates of total Canadian CFC use in 1988, as reported in the Corpus Information Services' listings for fluorochloromethanes were 19,500 metric tonnes(mt.). However, it is suspected that this figure, and most others currently available, are very "soft".

Other estimates, for example, range between 16,080 mt. to 24,700 mt. These may have been based on earlier use analysis figures, or may have accounted for Halon usage as well.

Project research also detected variations of between 2% to 11% when comparing use analysis estimates, particularly in the area of percentage distribution of total Canadian consumption of CFCs in major product/use sectors.

The 19,500 metric tonne total Canadian CFC use figure chosen as base line for this study is derived from the March 1989 (revised)

"Corpus CPI Product Profile on fluorochloromethanes"-1988 use estimates.

The base line figures chosen for per percentage total Canadian CFC use by product/use category was derived from the CFC reduction report by Friends of the Earth titled "Healing the Sky", published in June 1989.

The choice of these particular figures as base lines for the project was made on the assumption, not that they were necessarily "harder" or more accurate then other available figures, but simply because they were the most current and complete.

Based on these figures then, the 1988 distribution of CFCs by product/use in Canada was as follows:

TABLE 2
Estimated Use of CFCs in Canada (1988)

USE	VOLUME	% of total
Refrigerants	6,800 mt.	35 %
Blowing Agents	7,500 mt.	38 %
Aerosols	400 mt.	2 %
Solvents	2,200 mt.	11 %
Misc.	2,600 mt.	14 %
Total	19,500 mt.	100 %

I.3) Other Assumptions:

In order to measure some degree of reasonable probability to what often were extrapolations on the physical data acquired through the project survey, it became necessary to drawn on a number of other assumptions in order to develop a possible "use scenario" for measuring results. Those assumptions are:

i.) Ontario consumes about 50% of all CFCs used in Canada, or about 1.25% to 1.3% (9,375 to 9,750mt.) of the total world supply of 750,000 mt.of CFCs;

ii.) By removing the Ontario statistics from the total Canadian use figure (19,500 mt. minus 9,750 mt.), an estimated figure for the rest of Canada remains; that is: 9,750 mt.

iii.) Assuming the probability of relatively constant or uniform distribution and consumption patterns of CFCs across Canada (excluding Ontario), which in turn are linked in direct proportion to each province's percentage of total Canadian population, estimates

of total CFC use in Nova Scotia during 1988 were estimated at 518.7 mt.:

population of Canada	26,247,800
minus population of Ontario	-9,580,900
	16,666,900
population of Nova Scotia	887,700
887,700 as % of 16,666,900=	**5.32%**

iv.) Assuming therefore a CFC consumption rate for Nova Scotia equal to 5.32% of 50% of total CFC consumption in Canada, (9,750 mt.), the total estimated Nova Scotia consumption of CFC should be :

0.0532 X 9,750 mt.= **518.7 mt.**

v.) Assuming also that provincial rates of CFC consumption by product category are relatively consistent with national figures in this area, a projected CFC use analysis for Nova Scotia can be estimated as follows:

TABLE 3
Projected Use of CFC's in Nova Scotia (1988)

Product	Cdn. Quantity (tonnes)	% of total use	50%Cdn. Quantity (tonnes)	%N.S. use of 50%Quan.	est.N.S Quantity (tonnes)
refrigerants	6,825	35%	3,413	5.32%	181.6
blowing agents	7,410	38%	3,704	5.32%	197.1
aerosols	390	2%	195	5.32%	10.3,
solvents	2,145	11%	1,073	5.32%	57.1
misc.	2,730	14%	1,365	5.32%	72.6
total	19,500	100%	9,750		518.7

vi.) Assuming a fair degree of validity to these calculations, Nova Scotia's consumption of CFC's in 1988 probably represents about 2.7% of all CFCs used in Canada, (518.7-:- 19,500=0.0266 or 2.7%).

This estimate is within 0.7% of the "CFC use scenario" that predicts a use patterns for Canadian provinces (other then Ontario) roughly equivalent to their per cent of total Canadian population, which in the case of Nova Scotia is 3.4%.

Figures from Table 2.,have provided a crude but reasonably accurate tool for measuring the validity of data collected by the survey and to guide projections derived from that data.

PART TWO

Survey Results and Strategic Considerations

The project survey, other project investigations, and the report on findings which follows, focused on eight major categories of manufactured products which contain CFC's or Halon, or use CFC's as part of their production processes. These categories include:

1. rigid foam (closed cell)
2. flexible foam (open cell)
3. refrigeration (home and commercial)
4. air conditioning (automobile, home and chillers)
5. solvents
6. hospital sterilants
7. aerosols
8. fire extinguishers

Although products which contain CFC's or which have been made by processes involving CFC's are as ubiquitous in Nova Scotia as they are elsewhere in the developed world, their use by the manufacturing sector here is relatively small. In fact, general estimates suggest that Nova Scotians annually consume only about 2.7% of the total supply of CFCs in Canada, or about 518 metric tonnes. While this may or may not be a surprising statistic, it is worth noting that Nova Scotia's use of CFCs within Canada is almost exactly equivalent to Canada's portion of worldwide annual consumption.

2.0. Rigid Foams

Rigid foams fall into two main use categories; insulating foams and packaging foams, of which two basic types exist; polyurethane foam and extruded polystyrene foam. (See Figure 1).

2 1) Polyurethane foam

Polyurethane foam is manufactured using CFC-11 (trichloroflouromethane) as a blowing agent in a process which traps the gas in the cells of the product thereby giving it a high insolation or R-value per unit thickness. Emissions of CFC's therefore generally occur only when the material is cut or damaged, when on-site poured or sprayed applications are carried out, or during the in-plant manufacture of board, slab, laminated or bun stock.

Uses: In Nova Scotia, rigid polyurethane foams are used primarily as insolation in construction applications-(sheathing, walls, roofing, basements and floors) and in refrigeration or cold storage applications-(refrigerated trucks and retail refrigerators and freezers), and are produced as laminated foam panels, poured/injected forms, sprayed forms, and bunstock (rigid slabs that can be cut into desired shapes). There are also many non-insulating applications, such as the manufacture of packaging material, marine and recreational floatation devices (buoys, surfboards, archery targets, etc.), dummy forms for taxidermy applications and artificial "soil" for floral arrangements etc.

Analysis of use patterns of CFC blown polyurethane rigid foam in Nova Scotia must distinguish between,

i.) urethane resins used for the manufacture of a wide range of products, but particularly insulation, and

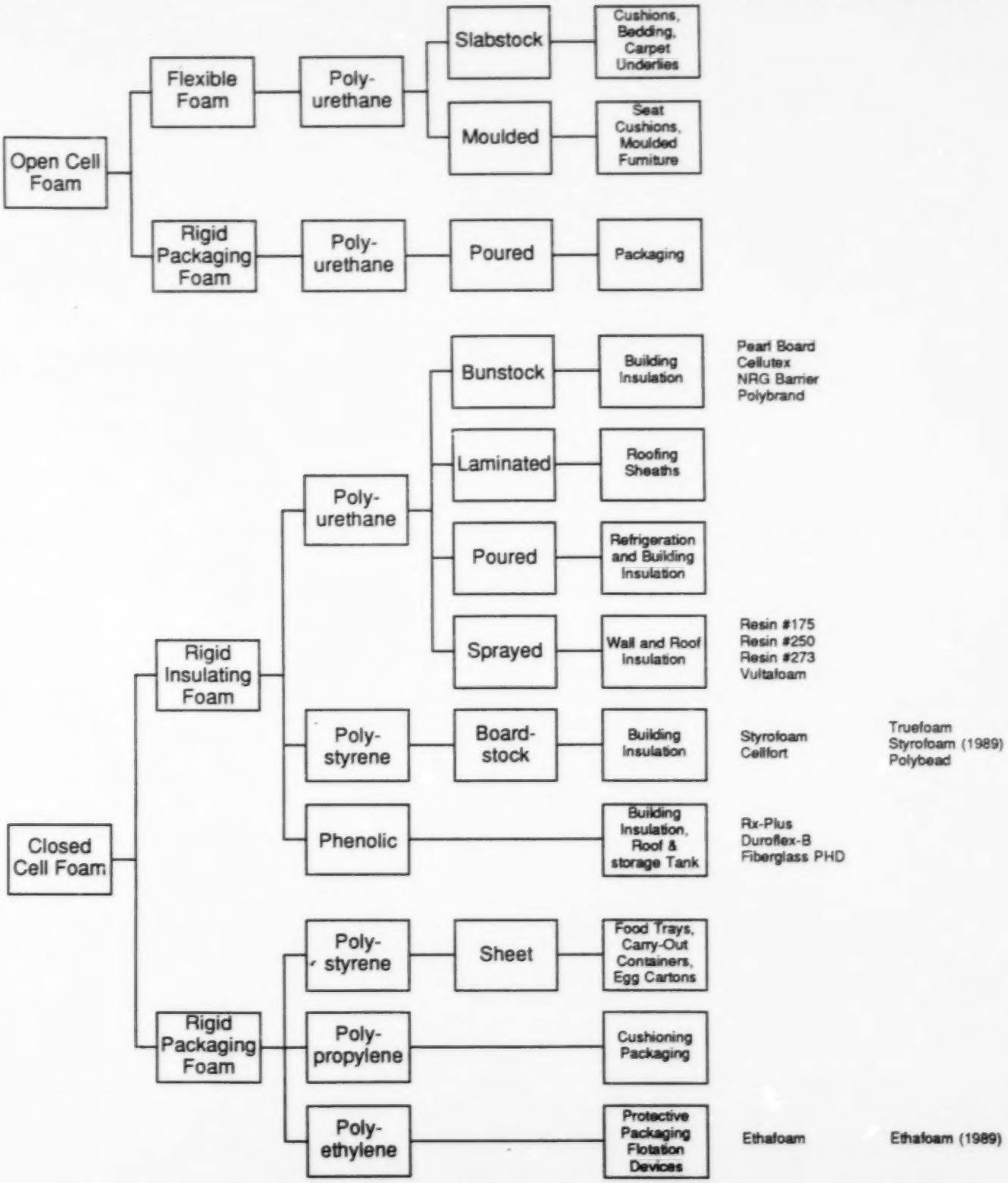
ii) the use of those same or similar "end" products sold in the province, which have been manufactured elsewhere with CFC technology.

Manufacturers/Industrial Users

i.) CFC blown urethane resins

By far the largest user of CFC based urethane resins in Nova Scotia is Guildfords Ltd. of Dartmouth which manufacture a rigid isocyanurite (urethane) insulation board called **"Pearlboard"**- the only such product manufactured in the province. Guildfords is currently manufacturing this product with a CFC-11 blended resin

Figure 1
Types and Major Uses of Blown Foams



mixture called **"Vultafoam"**, which is produced in the United States by General Latex and Chemical Corp., distributed by its Canadian subsidiary in Candiac, Quebec, and shipped to the Dartmouth plant in bulk tankers.

Guildfords reported in 1988 the use of over 88.0 metric tonnes of Vultafoam for the manufacture of its rigid insulation board, and an additional 15.6 metric tonnes for use in on-site spray applications for insulating cold storage warehouses, etc.

Guildfords has also reported the use in 1988 of about 1.6 metric tonnes of a C.I.L. produced resin called **"Resin #175"** for use in cold storage warehouse insulation. (C.I.L. products are distributed in Nova Scotia by their business unit, Stanchem, of Dartmouth.)

This 105.2 metric tonne total reported by Guildfords, however, may represent a minimum level of CFC resin consumption by this company since Stanchem has reported the sale of about 13.0 metric tonnes of two additional resin mixtures to Guildfords in1988/89; (**Resin #250** and **Resin #273**) Although unconfirmed, it may be that Guildfords has not reported these resins because it has been re-selling them in small quantities to other users rather then using them in its own in-house manufacturing purposes.

Guildfords' consumption of 105.0 to 130.0 metric tonnes of CFC based polyurethane resins probably represents about 75 to 80% of the total provincial consumption of such substances.

Up to 2/3 of the remaining 20-25% (12-28 metric tonnes) were consumed in other foam spray applications undertaken by the following companies identified through the project survey, all of whom used one or the other of the C.I.L resins mentioned above:

Table 4

Company/Location	Application	Volume
-Rex's Electrical, New Minas	-agricultural storage shed insulation	9,000kg
-Legay Fiberglass, Dartmouth	-industrial building insulation, -large flotation applications	1600kg
-Plastics Maritimes, Halifax	-resale to small users, -void filler & molds for fibreglass watercraft	2400kg
-Millard Ply Bows, Yarmouth	-fishing buoys/markers	2000kg
-Ellis Insulation, Bridgewater	-industrial building, tank and pipe insulation	1000kg
-Hermes Electronics, Dart.	-sonar/sensing buoys	650kg
-Mac Maritime Ltd.	-truck body insulation	650kg
	sub-total	17,300kg

Other small users such as taxidermy shops, floral supply businesses, etc, who may consume only 0.5kg to 2.5kg per year, likely account for an additional 50-200kg annually, with the remaining 5000-10,000kg of consumption projected to other likely users such as boat builders, refrigeration contractors, fishing industry supply manufacturers, etc. who either did not respond or were missed by the survey

Considerations

From a business point of view there are no cases among those firms cited above, including Guildfords, where the use or availability of the CFC based resins is directly related to the ongoing viability of these firms. In fact, in most cases these products contribute only fractionally to the scope of their respective overall business volumes. In the event that these CFC resins are removed from the market, adjustments could and would be made relatively quickly either through turning to alternate chemical mixtures, or by switching to completely different product or service lines to fill the resulting sales volume void.

Guildfords' is a relatively large and diversified building supply wholesaler and construction materials manufacturer. Despite their predominance as a user of CFC-based polyurethane resins for the production of the Pearlboard line, this activity reportedly represents only 3% of their total business volume. Over the last few years, Pearlboard has been losing market share due to increasing competition, lower housing starts and doubts in the construction and insulation industries over the integrity of stated R-values for isocyanurate foams. Consequently, the CFC issue notwithstanding, Guildfords' management is having to consider its continued production of the Pearlboard line in the medium term. The impact of impending federal or provincial restrictions on CFCs usage, in their case, may therefore simply tend to accelerate their decision to phase out production and/or switch to an alternative process or line of product.

ii) Imported CFC blown rigid foam products

In addition to Guildfords' Pearlboard there have been ten other rigid insulation foam products identified through the survey which are competing for market share in Nova Scotia.

Of these, three are CFC-11 blown isocyanurate or polyurethane rigid foams produced either in central Canada or the US; These products are::

-**Cellutex** US manufactured distributed by Bird-Stairs Ltd.
-**NRG Barrier** US manufactured distributed by Cornerstone Construction
-**Polybrand** Brandford Ontario distributed by Plastics Maritimes

Although sales volume figures for these products are not available, estimates by officials in the industry suggest that these products in total occupy a relatively small market share due to their limited distribution and higher price. - eg. Plastics Maritimes sells less than 1000 sheets/year accounting for less than 1/10th of 1% of their total annual sales.

2.2) Polystyrene foam

Polystyrene foam has been used widely to make food packaging, insulation, and foam shipping/packing materials. There are three types of polystyrene foam, distinguished by method of manufacture, most of which have until recently used CFC-12 as the blowing or foaming agent.

However, due to the technical ease of switching to alternative blowing agents in the production of polystyrenes, at least relative to other rigid foams, there has been during the past few years a fairly swift and significant shift away from the use of CFCs in this segment of the industry in favor of more benign production methods.

In two of the four product categories mentioned above, the polystyrene industry in Nova Scotia virtually guarantees that no CFCs are used, either in the production processes, or in other uses of the products made from these groups of foams. Included here are:

i). Extruded formed polystyrene sheet (XPS)
-Used mainly in the single-service (food) industry and supermarket meat and produce trays; egg cartons, coffee cups hamburger containers,etc.

ii). Molded expanded polystyrene sheet (MEPS)
-Used for building insulation, custom packing and filler "peanuts", ice chests, flotation devices.etc.

In these cases, both Canadian and American producers have, as of January 1, 1989, completed a voluntary substitution program to replace CFC-12 with alternative non-halogenated blowing agents or HCFC-22, which has a 95% reduced ozone depletion potential.

Truefoam Ltd. of Dartmouth, manufacturer's of **Truefoam** insulation board, is among those producers of expanded polystyrene whose process does not employ CFCs. Truefoam reported that they use the hydrocarbon blowing agent n-pentane, exclusively. Truefoam

also commands by far the largest market share in the province for rigid foam insulation board.

The two remaining categories of polystyrene foam are still for the most part manufactured with the use of CFCs, and all are produced exclusively as insulation board. Although none of these products are manufactured in Nova Scotia, there have been five product lines in these groups identified in the Nova Scotia market. These include:

iii). Extruded expanded polystyrene board (XEPS)

Styrofoam SM, HI100, HI140, & HI160

This product line is produced by Dow Chemical, is available through most building supply centers and enjoys a relatively large part of the Nova Scotian market. As of September 1989, however, Dow will be producing this product with a non-CFC substance-probably HCFC 142b. However, much ,if not most of the existing inventories in the province are likely to be of the CFC blown variety for up to six months or more.

NOTE: Dow chemical has chosen to use the term "HFA" or "hydroflouroalkane" to identify the "new" blowing agents.for their lines of rigid foam products. This, however is simply a more generic way of identifying the standard HCFC and HCF group of chemical proposed as possible alternatives for chloroflourocarbons. It does not signify a new substance. ie. HFA-142b = HCFC-142b

Cellfort

This is a CFC blown US manufactured product distributed in Nova Scotia by Domtar and occupies only a small market segment.

2.3) Other Rigid Foams

i) Extruded polyolefin or phenolic foam

Three brands of phenolic foam insulation board are available, or about to be available, in Nova Scotia. These include:

Rx-Plus

manufactured in the US and distributed locally by Domtar

Duroflex-B

Distributed locally by BPCO Inc.

Fiberglass PHD

This is a new product, scheduled for introduction to the market in early 1990 and likely will be distributed by Guildfords.

To date phenolic foams have accounted for only a small fraction of CFC use. However, two new Canadian phenolic board plants have recently been built and could significantly increase the consumption of CFCs in this sector, likely at the expense of the polyurethane industry. Phenolics are a very competitive product since 95% of the CFC-11 used as blowing agent is trapped in the closed cells of the product giving it a very high R-value/unit of thickness.

ii) Extruded Polyethylene foam

-Ethafoam

This is a Dow Chemical product and was the only foam in this category identified by the study. It holds a 75% share of a relatively small specialized high quality market in packaging, gasketing, cushioning, pipe insulation, flotation, recreational and sporting goods. As of October 1989, Dow claims it will be phasing out CFC-11 and CFC-114 production of Ethafoam during a two year HFA (ie. HCFC-143b) substitution program.

Although some new Ethafoam products may be available by mid 1990, the full line-production and distribution of this foam product is not likely until 1991.

Metocean Data Systems Ltd. of Dartmouth was the only user of Ethafoam identified through the survey. In this case the product was used in the fabrication and packing of ice beacons.

Considerations

Since the public generally tends not to distinguish among the numerous different production methods used by the rigid foam industry, those foam products which are now free of CFCs, are (much to the frustration of industry officials), often lumped together in a generic condemnation of foam products. Furthermore, compounding the issue of CFC content in foam products, particularly in the food packaging and single service areas, is the issue of the increasing volume and persistence of foams in the solid waste stream.

Given the current availability of many safe and environmentally friendly alternatives for most foam packaging and packing applications, the potential for swift government

interventions to deal with both the CFC and the persistent waste problems of foam packaging are readily available, although not without difficulties.

For example, banning the production, sale, and use of CFC blown polystyrene products may serve to reassure and clarify the environmental acceptability of these products remaining in the market, for both the public and the industry, insofar as their potential for contributing to ozone depletion is concerned. But, by the same token, action only on the CFC issue may open the door further to the broader use of foam products in existing and new applications ,thus compounding the waste management side of the issue.

The measure of success for government initiatives in this area, therefore, hinges on whether the ozone layer protection legislation and subsequent control mechanisms are implemented such as to give the benefit of doubt to business and industry, or to the environment, and whether these initiatives accommodate or influence the development of integrated approaches to long term planning for environmental protection.

3.0 Flexible Foams

Flexible foams fall into the polyurethane foam category and are produced as slabstock and molded products.

Most flexible foams are produced using carbon dioxide as the blowing agent, but in frequent cases CFC-11 or methylene chloride is used as auxiliary or additional blowing agents to create lower density foams or softness.

Because the cells of flexible foams are open, CFC-11 is emitted within a few hours or days from the point of manufacture.

In-plant emissions therefore represent the largest source of CFC releases from these types of foams,.and, as such do not directly figure in Nova Scotia's inventory of emissions since flexible foams are not produced in the province.

However, Nova Scotian consumption of Canadian flexible foam production accounts for the use of about 35-45 metric tonnes, or approximately 0.2% of the total Canadian use of CFCs.

Manufacturers/Industrial Users

Flexible polyurethane foams are commonly used in Nova Scotia by most furniture upholstering and re-upholstering businesses, by mattress and carpet manufacturers, and are otherwise consumed

through the wholesale and retail sale of similar imported products manufactured by both Canadian and foreign companies. Most of the flexible slabstock used by these Nova Scotian firms is acquired from one of the 15 or more manufacturers of flexible foams in Ontario, Quebec or western Canada.

It was not known by any of the personnel contacted by the study in this sector, whether CFCs were used in the production of stock they had acquired from these sources since the disclosure of such specifications is not legally required or voluntarily provided by manufacturers.

4.0 Refrigerants

The industrial use of CFC refrigerants in Nova Scotia is more directly related to activities in the refrigeration service, repair and installation sector then in the manufacturing sector. Therefore consideration of CFC refrigerant usage in Nova Scotia focused on the servicing of:

i.) commercial refrigeration and air conditioning (sec.4.1)
ii.) residential refrigeration and air conditioning (sec.4.2)
iii.) mobile air conditioning (sec.4.3)

The CFCs used primarily throughout the refrigeration and air conditioning industry are:

CFC-11, or R-11
CFC-12, or R-12
CFC-115, or R-115
R-500, a blended mixture of R-12 and HCFC-152a
R-502; a blended mixture of R-22 and R-115

The "R" prefix is used by the refrigerant industry to distinguish between those CFCs used for cooling, from those used for other purposes, such as blowing agents for foams, etc.

It is estimated that about 67% of the total amount of CFC refrigerants used in Canada are loaded into equipment by service personnel either as initial charge (large installations), or are used to replenish refrigerants leaked or vented to the atmosphere during use or servicing. The remaining 33% is due to manufacturing.

In Nova Scotia, this translates into a minimum anticipated annual use by the refrigeration services industry of approximately 122.0 metric tonnes of CFCs, plus an additional 2-3% (2,440kg.) accounted for by the sale of imported CFC operated home refrigeration units (none of which are manufactured here).

Studies conducted elsewhere suggest that after market emissions from refrigeration and air conditioning equipment account for up to 88% of all combined emissions of CFCs as a result of product use.

Fortunately, this startling fact has not been lost on the refrigeration services industry in Nova Scotia and wide spread awareness and concern over this statistic, at all levels, was discovered during the study.

As a consequence, some firms have individually promoted awareness of the problems of CFCs to their service personnel, and are actively discouraging the widespread practice of "blowing the charge". Some suppliers are facilitating recapturing practices by purchasing or trading used refrigerant on a limited basis, or are marketing refrigerant recapturing/recycling units (vampires). Others have simply passed on to their employees relevant information issued from a number of national and/or provincial industry associations.

However, notwithstanding these relatively ad hoc efforts, there was not reported any concurrent effort or plan by the industry as a whole in Nova Scotia, to promote voluntary recycling or recovery programs, nor to institute industry wide codes of practise or other such mechanisms to back up their concerns more comprehensively.

In short, the industry here seems to be taking a "wait and see" approach, choosing to monitor the development of new and less hazardous refrigerants, and new equipment design specifications, or await anticipated government interventions. With respect to the latter, the industry has a number of concerns, some of which are as follows:

i.) the implementation of regulations or other restrictions which might impact the relative competitive advantages between large and small service businesses;

ii.) the development of standards for the controlled re-use of recovered and recycled refrigerants;

iii.) the standardization of inter-provincial transportation regulations and hazardous substance classifications as pertaining to recycled refrigerants(CFCs);

iv.) the development of regional re-processing facilities, such as are now available only in central Canada;

v.) the licensing of the automobile air conditioner service trade; and

vi) user education, and industry wide consultation.

Clearly, the refrigeration and air conditioning industry in Nova Scotia expects, and is awaiting government intervention in this area, and appears prepared to cooperate and participate fully in the development and implementation of sound CFC control policies and programs.

4.1) Commercial refrigeration and air conditioning

Distribution of refrigerant in Nova Scotia are handled by five refrigeration and air conditioning equipment and supply companies. The largest of these are R.L. Fulton Equipment Ltd. of Halifax, who reportedly supply and distribute about 50%-60% of the total volume of refrigerant used in the province. Refac, the refrigeration and air conditioning wholesale division of Westburne Industrial Enterprises, of Halifax, and Kerr Controls Ltd. of Truro, each account for approximately 14% to16% of total provincial sales, and the remaining 14%to 18% total volume is shared more or less equally between D.S. Fraser Ltd. of Halifax and Lennox Industries Ltd. of Dartmouth.

-Fulton Equipment reported the sale of the following volumes of CFC refrigerants in 1988, of which about 20%(24.8mt.), was sold in Newfoundland by their St. John's branch:

Table 5

Substance	Volume	Source
R-11	9,200kg.	duPont
R-12	72,900kg.	"
R-113	125kg.	"
R-500	84kg.	"
R-502	41,491kg.	"
sud-total	123,800kg.	
	-24,800kg. (Nfld.)	
Total	99,000kg.	

-Refac was unable to report concisely on provincial figures since no such distribution breakdowns were maintained by their national office. However, the following estimates were provided by their Atlantic region office:

Table 6

Substance	Volume	Source
R-11	3,000kg.	ICI 60%, Allied signal 40%
R-12	16,000kg.	ICI 75%, Allied Signal 25%
R-13B1	15kg.	Allied Signal
total	19,015kg.	

Kerr Controls reported the total distribution of about 34,580 kg. from its Truro facility in Nova Scotia, of which about 6-8,000 kg. are re-distributed to their Newfoundland branch.

Table 7

Substance	Volume
R-11	3,820kg.
R-12	22,390kg.
R-500	30kg.
R-502	8,740kg.
total	34,580kg.
less Nfld. vol.	6,000kg.
N.S. total	28,580kg.

-D.F. Fraser Ltd. and Lennox Industries share the remaining 25-35,000kg. of total provincial sales. Lennox, being specialized in air conditioning, is the largest volume distributor of R-22, ie. HCFC-22, in Nova Scotia. However, R-22 is not one of the substances being considered in this report and thus has not been counted.

The total volume of CFC refrigerants distributed in Nova Scotia from these sources, as determined through the survey and other investigations during the study, therefore, is about 181,595kg, and compares very favorably to the projected estimates figure for refrigerants shown in Table 3.

Major Industrial Users & Other Considerations

According to a number of industry officials contacted, the largest users of CFC refrigerants in Nova Scotia are:
i.) supermarkets, ii.) large food processing plants (especially fish processors), and iii.) refrigerated road transportation companies (including those of the food processing industry).

If national figures hold true for Nova Scotia, these operations could account for the use of about 62,000kg. of R-11, R-12 and/or R-502, or about 12% of the total provincial CFC consumption.

According to several local industry officials, there already appears to be some headway being made the by major equipment manufacturers in the design and marketing of more easily serviceable and HCFC-22 operated units or HCFC conversion specifications. However, the continued availability and cheaper price of CFC-12 systems, and the lack of customer awareness or concern with the broader issue of CFC reduction, according to reports from several industry officials, usually results in customers

favoring the price advantage of a CFC-12 system over, for example, a less competitively priced R-22 system. Since this sort of market dynamic in the trade of CFCs is not likely to change of its own accord in the short term, it is certain that forced changes will be necessary.

The same sort of negative market pressures or disincentives exist in the area of refrigerant recycling. For example, in the case of service company "A" who have undertaken, to recycle CFC refrigerants voluntarily, by necessity must pass the extra costs in time and equipment on to the customer, while company "B", a non-recycler, "blows the charge" avoids the costs, undercuts company "A's" service charge, and gets the job.

While, (as reported in the case of one firm involved in the servicing of refrigerated road transport units in New Brunswick), the initial capital cost of recycling equipment can be recovered by charging customers for their own recycled (and cleaned) R-12 at a cost equivalent to the retail replacement value of an equal amount of new R-12, (which in this case is about 4-5kg./unit), such uncontrolled windfall practices should neither be overlooked or considered acceptable to the the public sector or the industry as a whole.

4.2) Residential refrigeration and air conditioners

i) Residential refrigeration

According to 1988 figures provided by Statistics Canada, there are 307,000 homes in Nova Scotia which have one or more refrigerators, 20,000 of which have two refrigerators or more, and 189,000 households with one or more freezers. There are therefore roughly 516,000 such units in the province.

Statistics Canada also reports that there were 5,418 additional new single family housing units built in Nova Scotia in 1988, for which there probably was created an additional demand for about 5,000 new refrigerators, and 3,000 new freezers.

Allowing for a generous attrition rate of 25% for old units there would appear to be about 387,000 residential refrigerators and freezers in Nova Scotia homes.

Home refrigerators and freezers contain approximately eight to ten ounces, or 0.2 to 0.5 kg. of R-12 respectively, In total, this implies that there are, collectively "banked" in the kitchens of Nova Scotian's approximately 162,400 kg of CFC-12. This is roughly equivalent to the total CFC consumption rate of all industrial,

commercial, and retail refrigerant users for all purposes annually in the province. It also adds an additional 2,500 kg. to Nova Scotia's1988 sum total use of "new" CFC refrigerants.

While the CFCs locked into the closed systems of most home appliances are relatively safely "banked", emissions of their refrigerant generally occur only when they leak due to damage, when they are being serviced or when they are discarded.

Re-capturing refrigerant from domestic appliances is not a technical problem for the service industry since any certified technician has the necessary equipment and knowhow. The problem at this stage, barring the existence of any structured household appliance collection programs, is the unacceptably high decommissioning cost to the customer, which can range from $40 to $80 per service call.

Home refrigerators also typically incorporate about three times as much CFC-11 foaming agent in the polyurethane insulation in their walls as R-12 refrigerant in their cooling systems.

Considerations

New domestic refrigeration systems are not likely to be introduced to the marketplace for another 15 years or more. In the meantime, the consumption, control and eventual disposal of this growing inventory of "banked" R-12 in home refrigeration units will have to be carefully managed by, all concerned. Following are a few suggestions:

1.) Homeowners must be made aware of the need to regularly clean refrigerator coils, and inspect units for damage or mechanical problems, to insure that only certified technicians conduct repairs, that refrigerants are captured and not be vented, and finally ,to ensure that when disposed, units have their CFCs safely removed and the carcasses are safely disposed .

2.) The refrigeration service industry and governments (municipal and provincial) must cooperate in implementing joint programs to provide better technical training and upgrading for home appliance service personnel, to facilitate the development of uniform re-use/re-cycle practices and standards fairly throughout the service industry, and to facilitate the development of a provincial re-processing, storage and disposal depot especially for CFC refrigerants.

3.) Both the provincial and municipal governments must establish regulations or by-laws requiring mandatory reclamation of drainable CFCs from domestic units, and establish minimum

standards for the refrigeration services industry to prevent unnecessary venting of CFC refrigerants.

ii) Residential air conditioners Residential, room, or unitary air conditioners generally do not use or contain CFC refrigerants. These unit apparently use R-22 or HCFC-22 (chlorodifluoromethane) exclusively, thus will not be considered by this study. HCFC-22 is among the so called "soft CFC" group of substances, and in this case has a 95% reduced ozone depletion potential.

4.3) Mobile air conditioners

Automobile air conditioners (including cars, trucks, buses, etc) use R-12 exclusively, and account for 13% of the total use of CFC's in Canada. Approximately 40% of domestic and foreign cars sold in Canada have air conditioning. Car air conditioners contain much larger volumes of R-12 (1.3kg. to 1.7kg.) then home refrigerators (0.2kg. to 0.2kg.).

It is estimated that 66% of all CFC emissions due to product uses are attributable to automobile air conditioners, of which 34% are due to leakage, 48% to servicing and re-charging, and 18% to accidents, disposal, and manufacturing.

The Motor Vehicle Manufacturing Association of Canada has confirmed that aftermarket servicing accounts for most of the CFCs used for mobile air conditioning systems in Canada. Recycling and recovery technology is readily available and in broad use in the US where EPA and the industry have adopted a program to cut automotive CFC emissions by half. Manufacturers claim that recovery equipment is no more expensive then the recharging equipment currently in use and that 95% of drained air conditioning fluid can be recycled or reused.

Ford Motor Corporation Canada has recently announced that it will be supplying all its Canadian dealerships with air conditioning recovery/recycling equipment by 1990.

Manufacturers and servicing

The major manufacturing activity in Nova Scotia involving automobile air conditioners is that undertaken by Volvo Canada Ltd. at their Halifax assembly plant. Volvo has reported the purchase of 6,600kg of R-12 acquired directly from duPont Canada(ie. not purchased through a local distributor). This amount of R-12 is

enough to load the initial air conditioner charge for 3,800 to 5,000 cars.

There was no particular effort made during this study to determine the total quantity of R-12 used or brought into Nova Scotia for mobile air conditioning purposes. Needless to say, it is a significant amount, and one, which for the most part, is being handled by personnel who are neither trained, qualified or obliged to meet the standards of service and safety otherwise expected throughout the rest of the refrigeration and air conditioning industry.

Servicing of car air conditioners is common among all new car dealerships in Nova Scotia, and is frequently carried out by smaller service stations, refrigeration service and repair firms, and by a number of repair shops who may offer a variety of specialized repair services for cars. Often these "repairs" consist only of recharging spent fluid using aerosol recharge cans of R-12 which have been readily available from both wholesale and retail automobile supply stores, such as Canadian Tire. These cans may soon come under federal regulations and be removed from the market.

Due to the absence of refrigerant recapture/recycling equipment or any requirement to use such devices, the general sequence of repair practices for these units has been, and generally continues to be, "vent, repair,recharge".

Considerations

In order to gain some control over the use and senseless emission of R-12 from mobile air conditioning units, the following provisions should be considered for implementation:

- technical training programs, licensing processes, and the application of minimum standards for servicing mobile air conditioning systems must be quickly put in place, and once developed, should be overseen by both the automotive dealer associations and those of the refrigeration and air conditioning services industry, as well as government regulatory and licensing agencies;

-If not already restricted, across-the-counter sale of R-12 re-charge cans should be banned, or restricted for use only by licensed repair shops or technicians;

-Licenses for the repair or recharging of mobile systems by all automobile service shops should be limited to the extent that they employ certified technicians and maintain effective recycling equipment ;

-all vehicles with air conditioning equipment destined for disposal or scrapping must have the refrigerants safely removed, and be so tagged, by either the trade-in dealership or accepting wrecking yard; and

-Owners of cars with air conditioning units should be required to show an annually verifiable "Air Conditioner Integrity Sticker" on their vehicle to encourage good owner maintenance practices.

5.0 Solvents

CFC solvents are used to remove contaminants from manufactured parts, primarily electronic components, metal, and pharmaceutical and medical products. The primary substance used for solvent purposes is CFC-113, although CFC-11 and CFC-12 also are extensively used. The advantage of CFC solvents over other cleaning or degreasing agents is their high degree of purity, their low toxicity, and their compatibility with the materials being cleaned, especially plastics and polyvinyls.

In Nova Scotia, solvents account for approximately 11%, or about 60,000 kg.of total CFC use, the majority of which is used for electronics cleaning.

In the use of CFC solvents, emissions occur in four major areas depending on the application or method of use. These areas are: bath evaporation, solvent carry-out, evaporation of waste solvent, and aerosol spray evaporations.

Large users of CFC solvents are now beginning to develop their own recycling programs and are now sending used solvent out for commercial recycling, or are actively modifying standards and processes to accommodate the use of substitute solvents. Northern Telecom, one of these large users, for example, has committed itself to the elimination CFC use by July 1,1991. Northern Telecom's facility in Amherst is among the divisions of this company who will be implementing the voluntary phase-out program.

As for the many small users of CFC solvents, such as there are in Nova Scotia, conservation and recycling practices, if practiced at all, vary widely and effective control of emissions is not likely without the intervention of industry guidelines, codes of practice, education programs, and/or government imposed regulations.

Distributors/users

Over 80 individual firms in the communications, electronics, metal machining and aeronautical industries, etc. were surveyed by

the project. However, only three firms responded to this initial request for information (3.75%) with relevant data. Subsequent follow-up investigations focused on local electronic equipment and chemical distributors,(and to a lesser extent, national distributors), from whom the data acquired formed the basis for this aspect of the study.

5.1) Local distribution

i) Aerosols or small volume liquid gaseous solvents

The lines/types of CFC solvent carried by local electronics supply firms contacted by the project, and the volumes sold, are as follows:

M.G. Chemicals Ltd., Bramton, Ont. manufactures the extensive "MG 400" line of CFC-11, CFC-12, and CFC-113 based liquid gaseous and aerosol sprays which are used in a wide variety of electronics applications, including: cold sprays and super cold sprays, circuit board cleaners, de-greasers, flux removers, VCR head cleaners, contact cleaners, dusters, and static sprays, etc. While there are indications of a conversion by MG to the increased use of HCFC-142b or other "soft CFCs", current inventories still consist largely of the CFC varieties. Distributors of MG Chemical CFC products, their respective estimated % market shares, and the total volume of product sold are as follows:

Table 8

Distributor	% Market
-RAE Industrial Electronics Ltd., Dartmouth	40%-50%
-Weeco-Maritimes Ltd., Dartmouth	20%-30%
-Munro Electronic Parts & Service Ltd., Dart.	20%-30%
-Arcom Electronics Ltd., Dartmouth	5%-10%
approx.total	2,140kg.

Chemtronics Inc. of Hauppauge, NY., manufacture a similar, although longer line of products to those of MG Chemical, of which at least 17 are CFC based and available in Nova Scotia through many of the same distributors.

-Munro Electronic Ltd. appears to be the largest distributor of these product, accounting for as much as 60% of provincial sales, or about 8,316 kg. in 1989. The remaining 40%, or 2,700 kg. appear to be more or less equally shared between Weeco-Maritimes, and Arcom Electronics, yealding an

approximate total sale of slightly over 11,000 kg. of Chemtronic's CFC solvents.

General Cement & Chemical (G-C) aerosol solvents are available from RAE Industrial, and was the only other such product identified and was considered to be an anomaly, or residue of old stock.

ii.) Liquid or liquid gaseous solvents

Larger individual volume sales of non-aerosol liquid CFC based solvents for the electronics industry in Nova Scotia are generally acquired from local chemical distributors and agents for major CFC producers, such as duPont, and C.I.L, the national distributors for ICI chemicals(Great Britain). Although there may be others, investigations through this study identified the following:

Table 9

Distributor	Product		Volume
- R.L.Fulton Ltd.	Freon TF	duPont	2,100 kg.
	Freon TWD 602	duPont	3,900 kg.
-Stanchem	Arklone P	ICI (C.I.L.)	7,900 kg.
	Arklone L	ICI (C.I.L.)	1,700 kg.
	total volume		156,000.kg.

5.2) Out of province distributors

i.) Aerosols and small volume liquid gaseous solvents

There are three product lines in this category currently known to be in use in Nova Scotia, namely:

Table 10

Manufacturer/Distr.	Major users (speculative)
-Miller Stevenson	MT&T, and others
-Electosonics	Linton, Pratt&Whitney,etc.
-CRC	N.S.Power, Michelin

These lines reportedly became established, particularly among institutional, government agency, large industry, and public utility users, as a result of "give-away" promotional efforts some years age, and have since become the primary products of this nature used by these facilities. MT&T was the only such user contacted to confirm the use of CFC solvents so acquired (306kg. from Miller Stevenson), but, it was reported by others that N.S. Power, most universities, community colleges, and technical training schools, federal and provincial government laboratories (ie. BIO, DND, NSRI,etc.), and large industrial firms such as Hermes, Linton, IMP,

Michelin, Pratt & Whitney, etc., probably use quantities of between 5.0 to 300 kg. each of the aerosol products acquired directly from these out of province sources.

ii.) Liquid or liquid gaseous solvents

There were two cases reported of larger quantity sales purchases of CFC solvents from out of province sources, and one odd case of a very small quantity from such a source. These were:

Table 11

User	Product	Volume
Hermes Electronics Ltd.	Freon MF/duPont	280 kg.
LSI Logic Corp. (Can.)	Freon TMS/duPont	3,000 kg.
Metocean Data Systems	Gensolv DES/Allied	8.5 kg.
	total	3,288.5.kg.

Considerations

There are literally hundreds of CFC solvent user in Nova Scotia, ranging from the large industrial and institutional users mentioned above, to small often "fly-by-night" electronics manufacturing and repair shops, to home hobbyist. In total, these uses amount to an unknown, but unquestionably significant volume, the vast majority of which is lost to the atmosphere during use.

The wide choise of CFC solvents and cleaners available in the Nova Scotia market, and the general uses to which these products are applied, for the most part greatly exceed the technical standards for electronics cleaning required for most of the applications for which they reportedly are used.

The standards for electronic component cleanliness made achievable by the use of CFCs as solvents and cleaners, has been institutionalized throughout the electronics industry by the general adoption of American military standards for manufactured components for military and aero-space applications. This, combined with the relatively low cost of CFCs and their logical packaging in aerosol cans, where the CFC can serve as both propellant and active ingredient (thereby escaping restrictions), has given rise to their spectacular growth and wide spread use on the electronics solvents market.

In other words, the vast majority of current CFC solvent and cleaning applications in Nova Scotia can quite adequately be served by a variety of other readily available products, and still maintain product quality standards appropriate for most applications.

Consequently, with the exception of few applications by industries involved in the manufacture of sensitive listening, and

communication devices, CFC based solvents could quite easily, and without undue disruptions in the industry as a whole, be phased out over a relatively short time. This is particularly true in the case of many aerosol spray cleaners sold across the counter to the general public in the form of such products as VCR head cleaners,etc.

For "essential" applications, a permit/licensing mechanism should be developed requiring sound justifications for CFC solvent use, proof of emission control and/or recycling capability, and a comprehensive waste assessment and waste management plans.

At the private sector level, large national or multi-national companies, such as Northern Telecom, who are currently engaged in national CFC reduction programs, should be encouraged to assist smaller Nova Scotia companies in planning phase-out efforts, particularly for the transfer of new technologies in solvent emissions control, and alternate cleaning process.

In the small business side of the industry, electronics suppliers should be encouraged to voluntarily, or by regulation, disseminate relevant information on the atmospheric risks involved in the use of CFCs, distribute manufacturers' "material safety data sheets" with all sales of CFC based solvents, and provide "WHMIS-like" training to employees and others throughout the industry who handle CFCs.

6.0 Hospital sterilants and aerosols

These two categories were not investigated closely by this study because of the relatively small anticipated use of such substance in relation to other CFC use areas, the absence of any known manufacturers of either medical sterilants or aerosols in Nova Scotia, and the lack of time available to effectively cover these areas, given the scope of the study.

6.1) Hospital sterilants

CFC-12 is used in hospitals and medical industries in an 88%/wt. mixture with ethylene oxide to sterilize medical instruments and other devices. The market for gas sterilization is directly linked to the market for pre-sterilized, disposable medical and surgical equipment.

Although there is expected to be some use of such products in Nova Scotia's medical services sector, the volumes are anticipated to be relatively small.

Further investigations in this area are need.

6.2) Aerosols

At one time CFCs were used as propellants for a broad range of products. In 1980, Canada banned the use of CFCs in deodorant, antiperspirant and hairspray aerosol applications. Their use in other product lines since that time has steadily declined. In1986, it was reported that 10% of aerosols were formulated with CFCs, accounting for 11% of all CFC then use in Canada. By June of 1989, the Canadian Aerosol Information Bureau reported that less then 1% of all aerosols are now CFC propelled. However, CFCs are still used as propellents in some products, including perfumes, asthma inhalers, and mold release agents.

In the absence of labeling requirements for CFC content in aerosol cans, it is impossible, especially for consumers, to know for certain whether a spray can contains CFCs. Consumer response to this area of confusion has been the wide spread avoidance of purchasing spray can packaged products.

There have been three lines of aerosol spray found in local retail outlets which, by virtue of the fact that the CFC based aerosol used as the product's propellant is also either the active ingredient being sold, or an essential component of the active ingredient itself, have escaped the federal regulations banning aerosol sprays. These include several lines of:

-electronics solvent and cleaner (see 5.1 above),

-R-12 automobile air conditioner re-charge (see 4.3 above),

-injectable polyurethane foam insulation crack filler.

Control mechanisms discussed under the sections of this report dealing with CFC based solvents, refrigerants,and polyurethane resins should, if implemented, effectively.deal with the elimination of these nonessential uses of CFC aerosol propellant.

Further investigation in this area should also be conducted.

7.0 Fire Extinguishers (Halon)

7.1 Halon Survey

A separate and distinct survey was conducted by the project to gather data specifically related to the use of Halons as fire extinguishers in Nova Scotia.

Twenty two firms in this sector were surveyed of which 11 firms or 50% responded. Of these, two firms reported not handling Halon extinguishing equipment, one declined the request for information, another defered to its parent company, and seven, or 32% provided relevant data.

Base lines

There are very few Canadian Halon use analysis reports available at this time to which reference can be made to either form assumptions, or measure the accuracy of estimates. Therefore, pending the release of Environment Canada's current study on Halon use, this study has relied upon forecasted figures for 1990 from the Corpus CPI Product Profiles on bromochlorodifluoromethane (Halon 1211) and bromotrifluoromethane (Halon 1301), which were based on 1985 projections

According to Corpus projections for 1990, it was thought there would likely be a total demand in Canada for about 190,000kg. of Halon 1211 and about 590,000kg.of Halon 1301 by the year 1990..

Following the same reasoning adopted by the project's CFC survey analysis, Nova Scotia may account for about 5.32% of half the total forecasted demand for each of these substances; that is:

5.32% of 190,000 = 5,054 kg. of Halon 1211
5.32% of 590,000 = 15,694 kg. of Halon 1301.
estimate = 20,748 kg., total yearly Halons use.

As in the CFC phase of the study, these figures are to be considered measurements for checking the probable accuracy of estimates derived from the hard data collected by the survey.

7.2 Halon overview and survey results

Halons are similar to chlorofluorocarbons except that the Halon molecule contains a bromine atom instead of a chlorine atom.

These bromated chemicals (Halon 1211, 1301 and 2402) are very stable and very potent ozone depletes, having ODPs of 3,10 & 6 respectively.

Although currently produced in small quantities, the production of Halon is thought to be growing, specifically due to their highly desirable attributes as a fire extinguisher.

Halon fire extinguishers work by "choking" or suffocating fires rather than drowning them, and therefore are popular for delicate computer equipment, books and museum artifacts, all of which would otherwise be destroyed by water or other fire extinguisher chemicals.

Two types of extinguishing systems employ Halon:

i.) Total flooding systems:

Halon 1301 is used in total flooding systems for enclosed spaces where protection is required for valuable computer, electrical, and telephone equipment, pipeline compressors and pumping stations, libraries and museums,

airlines, ships engine and boiler rooms, and a variety of. military.applications.

ii) Hand-held fire extinguishers:

Halon 1211 is generally used in these smaller portable units which are usually employed in similar situations. Although most home fire extinguishers use water or dry chemicals, there are a number of Halon-charged home and car fire extinguishers currently in the retail market place in Nova Scotia.

Emissions of Halon generally occur only when extinguishers are activated by fires or, perhaps more frequently, as a result of inspection tests conducted in compliance with National Fire Protection Association and insurance underwriters codes for total flooding systems, which require that Halon be used as the testing agent.

Other emissions are affected through training exercises by personel in fire fighting occupations, or by those in other occupations whose duties include familiarity with fire equipment, eg. airline cabin and flight crews, etc.

7.3 Industrial and commercial users

All Halons used in Canada are manufactured in the US, Britain or Europe, and are imported and nationally distributed in bulk, (usually cylinders), or in products.

C.I.L.'s Stanchem division provides, what was described as a "distribution depot" at its Dartmouth facility were bulk orders of Halon products were kept in storage, presumably under contract for national distributors such as Chubb Security, Flag Fire Extinguishers, etc. for subsequent pick-up or shipping to local dealers approved as "original equipment manufacturers". Other than an on-going tally of inventories-in and inventories-out no records of this business activity were kept by Stanchem, nor were records maintained of the substances involved. One company official, however did confirm that there was generally a turn over of about twenty 90.7 kg cylinders per month.

This implies that about 21,768 kg. of Halon pass through Stanchem's gates per year -a figure which is so close to the project's projected total provincial consumption of Halons (20,748 kg.), that it deserves further investigation and conformation.

i) Total flooding systems - Halon 1301

The manufacture of Halon fire extinguishing equipment in Nova Scotia is limited to three or four companies who specialize in the design, specifications, supply, installation and often, the construction supervision, servicing and repair of Halon 1301 charged total flooding systems.

Those firms include in this category who responded to the survey, and the bulk volumes of Halon 1301 they used in 1988 were:

Table 12

User/Company	Bulk Volume of1301	Source
-D & L Engineering	907.2 kg	Fike Canada Inc.
-Mic Mac Fire & Safety	1,814.4 kg.	duPont Canada Inc.
	257.8 kg.	Chubb Fire Security
-D.R. Brenton Ltd.	1,814.4 kg.	duPont Canada Inc.
total	4,793.8 kgs.	

Although the end use customers of this total reported volume of Halon 1301 were not well documented, it is speculated that it was more or less evenly distributed between commercial and industrial applications, including redistribution to other service agents, and government applications, including the military.

ii.) Hand-held fire extinguishers - Halon 1211

These same companies also reported the following bulk volumes of Halon 1211, as did two additional service firms:

Table 13

Company	Bulk Volume of 1211	Source
-D & L Engineering	nil	n/a
-Mic Mac fire & Safety	4,625.7 kg.	Flag Fire Extgrs. Ltd.
-D.R. Brenton Ltd.	818.3 kg.	Flag Fire Extgrs. Ltd.
-Maritime Safety	272.2 kg.	Flag Fire Extgrs. Ltd.
-Foster's Fire Extgrs.	90.9 kg.	Flag fire Extgrs. Ltd.
total	5,807.1 kg.	

The following is the break down of Halon 1211 sold in manufactured hand-held extinguishers by the reporting firms:

Table 14

Company	number of units	Vol/unit	total	Source
Mic Mac Fire&Safety	24	0.45kg	10.8kg	Flag
	180	1.59kg	286.2kg	"
	236	3.17kg	748.1kg	"
	12	7.72kg	92.6kg	"
sub-totals	452		1,137.7kg	
D.R. Brenton Ltd.	1.0	1.0kg	1.0kg	Flag
	314	3.13kg	982kg	Sava
sub-totals	315		983kg	
Maritime safety	42	1.6kg	66.7kg	Flag
	80	3.17kg	254kg	"
	8	7.2kg	61.7kg	"
sub-totals	130		382.9kg	
Fosters (sub-total)	62	2.6kg	163.4kg	Flag
Totals	959		5,168.8kg	

There are, in addition to the 1211 Halon extinguisher sales reported above by licensed sales and service outlets, a number of national wholesale and retail chains who either distribute, or sell over-the-counter, Chubb and Flag manufactured Halon 1211 extinguishers for home use. These include; Black and Decker (Chubb), Canadian Tire, Home Hardware, and very likely many others like Sears, the Bay, etc.

Otherwise, the commercial use and handling of Halons in Nova Scotia is limited to the sixteen odd fire protection supply, servicing, and repair businesses who wholesale or retail Halon extinguishers, or provide recharging services.

Considerations

Since the 1985-86 Halon demand projections by Corpus Information Services were made (referred to earlier in this section), there has been reported from a number of industry sources, a dramatic drop in the use of Halon as a fire extinguisher -particularly of Halon 1301.

In this regard, a number of national fire equipment manufacturers' associations etc. have been quite successful in encouraging responsible Halon extinguishment usage throughout the industry, resulting in some significant shifts in individual company policy, production and use practices.

For example, one national company, Levitt-Safety Ltd. reports a 65% reduction in Halon usage from 1986 levels and exercises a policy of refusing to perform discharge tests.

Others report increasing numbers of new design specifications calling for CO2 as an alternative to 1301 in fixed systems, discontinued discharge testing by major customers like the Department of National Defence, or installation companies recommending 1211 systems for computer and laboratory applications.

Given these indicators, the total Halon use figures for Nova Scotia estimated above are probably poor indicators of actual usage in 1988-89 terms -especially for Halon 1301.

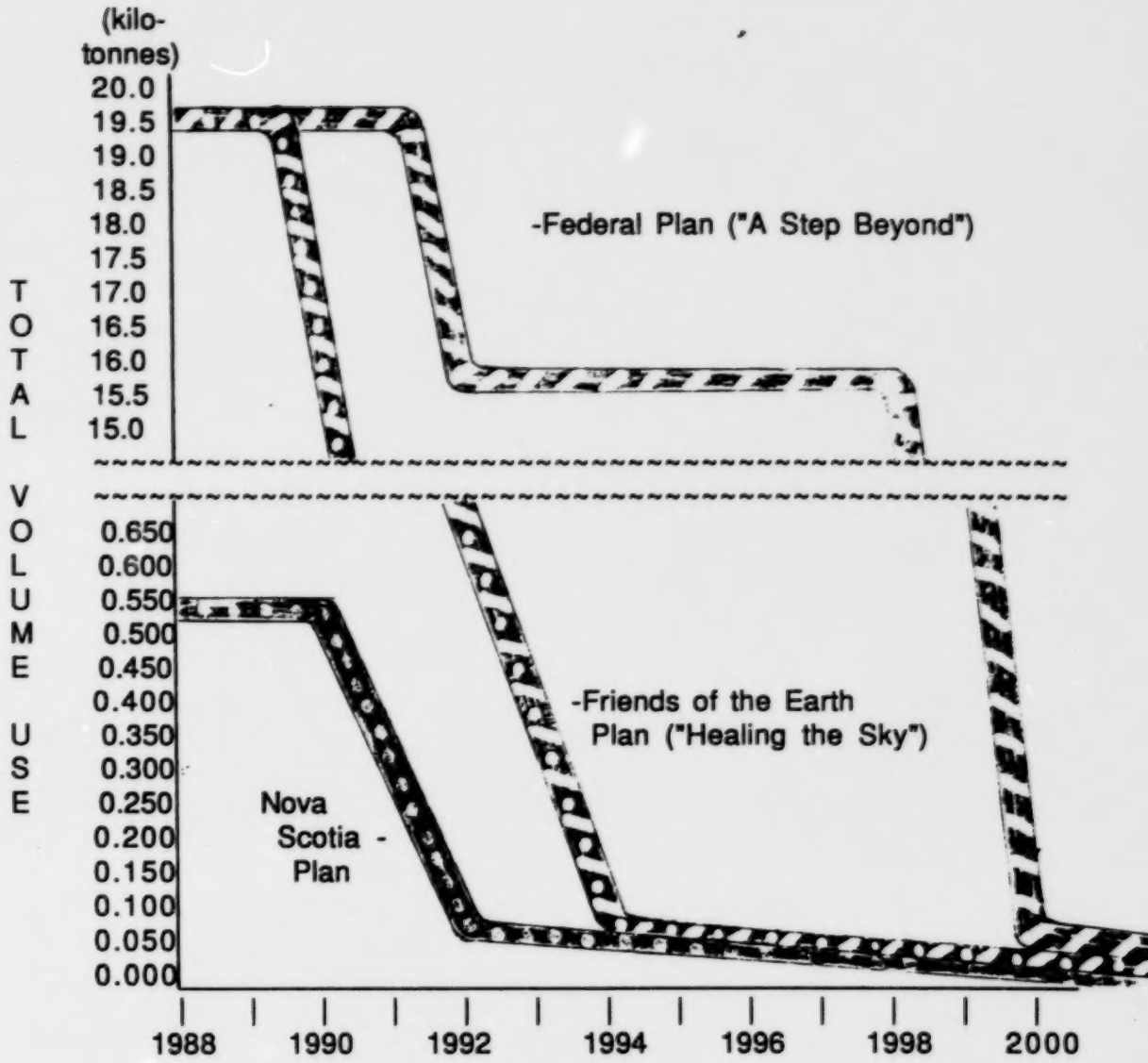
However, there are many areas of Halon extinguisher use in Nova Scotia where new additional control measures are needed and can effectively play a role in the controlled use and eventual phase out of these substances. Included here are such measures as:

- Restricting the sale of home use Halon extinguishers;
- implementing restrictive purchasing standards and guidelines for government use of Halon based extinguishers;
- requiring a province-wide substitution of non-Halon alternative systems or units for all current non-essential applications;
- establishing and managing Halon recycle/reuse and distruction facilities
- Banning discharge testing of Halon extinguisher equipment;and
- Requiring Halon emission control and recovery capability for 1301 total flooding systems as such technology becomes available.

Figure 2

CFC REDUCTION SCHEDULES*

Proposed Federal, FoE, and Nova Scotia Plans



*(Adapted from "Healing the Sky" Friends of the Earth, June 1989.)

PART THREE

Recommendations

The original commitment by the signatory countries to the Montreal Protocol, including Canada, was to cut back, by 1999, 50% of the 1987 level of global atmospheric emissions of CFCs.

Since that time there has been considerable international effort by governments and industry to reduce world wide production of CFCs and to find suitable alternatives with less ozone depletion potential.

In fact, the Protocol schedule for such cut backs has been accelerated at the national level in many countries such that ,for example in Canada there is now a target of 85% reduction by 1999 etc.

This has been achievable to a large extent because the perceived scale in the magnitude of the global CFC problem is much reduced when distributed among the participating nations who, with their respective regulatory powers and influence,soon realize the technical feasibility of accelerating phase out initiatives, not with standing the imperative of increasing scientific evidence to do so.

In general terms then,the rate at which any given jurisdiction can expect to phase out CFCs is inversely proportional to the magnitude of its dependency or use of CFCs. Given Nova Scotia's level of use, a mere 3-4% of the total national consumption, there is a very good possibility of achieving up to a 75-80% reduction of CFCs here by 1992 -well in advance of the federal 85% by 1999 target. Table 15 (below) will indicate where these reductions might be achieved.

There are three major ways to control CFC and Halon emissions into the atmosphere:

(i). Substitution with non- or less ozone depleting substances

(ii). Reduction of CFC losses during product manufacture and use; and

(iii). Recovery, recycling and disposal of CFCs prior to product disposal.

This range of control options are the fundamental basis of the control mechanisms suggested by the recommendations to follow. The recommendations fall into three categories; legal mechanisms; policy mechanisms; and program and partnership mechanisms.

Table 15.

Product Use Area	% of total CFC use	% Reduction by 1992	% reduction of total
Rigid Foams	30.8%	100%	30.8%
Flexible Foams	7.2%	100%	7.4%
Refrigerants	35%	63%	21.5%
Solvents	11%	100%	11%
Aerosols	2%	95%	1.9%
Medical uses	5%	100%	5%
Misc.	9%	80%	7.2%
	99.8%		77.4%

1.0 Legal Mechanisms

Under the authority provided by the Ozone Layer Protection Act, the Minister of the Environment should, with respect to:

1.1 **CFC-Blown Foam Products,**

-prohibit as of Dec. 31,1989, the manufacture, sale and use of CFC based packaging.

-Prohibit, as of July 1, 1990, the manufacture, sale and use of CFC-based rigid foam or sprayed foam insulation products and services.

-Prohibit the manufacture,sale and use of CFC-based flexible foam products, by July 1, 1990, and require labeling by manufacturers guaranteeing such products are not produced using CFCs by Dec. 31,1990.

1.2 **CFC-Based Refrigerants**

-Require by Dec. 31, 1990, mandatory reclamation of drainable CFC from all used commercial, retail, and domestic refrigerators, freezers, and air conditioning units, mobile air conditioners and Halon fire extinguishers prior to unit disposal.

-Require, by July 1, 1990, the adoption of minimum standards for the refrigeration services industry to eliminate the unnecessary use or venting of CFCs into the atmosphere during apparatus installation, repair and maintenance. These standards, proposed by the Heating, Refrigeration and Air conditioning Institute of Canada, include:

i. that all new installations of industrial and commercial refrigeration and air conditioning systems be those designed to operate on CFC-22 or other lower or non ozone depleting substance;

ii that all new installations incorporate receivers and isolation valve systems;

iii that CFC-11 or CFC-113 be substituted with alternate cleaning methods in flushing operations;

iv. that all refrigeration and air conditioning systems be pumped down and contained during servicing;

v. that the reuse, recovery and recycling of CFC refrigerants be employed where ever and when ever possible;

vi. that CFC-12 be replaced in existing systems with an environmentally safer refrigerant where feasible, practical and recommended by the equipment manufacturer;

vii. that pressure testing not be undertaken with CFC-12, but with an appropriate inert gas;

vii. that the use of one pound cans of refrigerant be forbidden.

-Require, by July 1,1990, that automobile dealerships, service stations, and air conditioner repair shops use refrigerant recovery systems.

-Require, by July 1, 1990, that the licensing of such companies be contingent upon their use of CFC recovery systems, and their employment of certified, licensed refrigeration and air conditioning technicians.

-Require, by July 1,1990, that the owners of vehicles with air conditioning units have their systems checked annually by a certified, licensed technician and be able to show proof of such as a condition for their vehicle registration.

-Ban the commercial sale of automobile air conditioner recharge kits.

1.3 CFC-Based Solvents

-Require the controlled sale and use of CFC solvents and cleaners on an application/permit basis contingent upon the proof of the

technical need for the use of such solvents/cleaners, and the submission of a CFC audit and waste minimization plan by the applying user.
-Ban the commercial sale and use of aerosol spray cans of solvent, cleaners, etc.which use CFCs either as active ingredient or propellant,or both.

1.4 **CFC-Based Aerosol Sprays**

-Prohibit the manufacture, sale and use of CFC-based aerosol spray can products except for essential medical applications.

1.5 **Halon Fire Extinguishers**

-Prohibit,by January 1,1990, the manufacture sale and use of Halon charged hand-held home fire extinguishers.
-Prohibit,by January 1,1990, the use of Halon in the testing of fire extinguishing equipment.

1.6 **Enforcement**

-engage such fiscal and human resources as required to enforce the regulations established under the Act,and, in addition, recommend, in those areas of enforcement which concern other departments of government, such as the Motor Vehicle and Road Transport Inspection Divisions of the Department of Transportation, etc., that their personnel also be informed and engaged in appropriate enforcement activities.

2.0 Policy Mechanisms

There are many areas in which the government itself can show leadership and be proactive in facilitating the task of meeting the requirements it imposes for the phase out of CFCs. These areas include:

2.1 **Government Purchasing Policy**

The Department of Government Services should be encouraged to establish and promote a government wide policy of avoiding the purchase of CFC-based products which are non-essential or for which non-CFC alternatives exist. This policy should be applicable to all agencies and departments of government, crown corporations, educational institutions, laboratories, and public utilities. Notice of such a policy should be widely distributed among suppliers of goods and services to the provincial government, including national and provincial industry, trade and professional associations.

2.2 **Promote the Development of CFC Recycling, Recovery, and Disposal Technologies**

In conjunction with the Department of Industry ,Trade and Technology, the Technical Innovations Branch, and the Technology Transfer Office, the Department of the Environment should undertake a search for appropriate CFC reprocessing, recovery, storage and disposal technology for Nova Scotia and, in consultation with the chemical, fire extinguisher and refrigeration and air conditioning services industry, seek out private sector partners to establish the necessary infrastructure for such a facility.

In the case of the recovery of small volumes of CFCs ,such as from spent domestic refrigerators, etc., the Department should promote and undertake annual, community based "white goods collection days" in cooperation with local municipalities, refrigeration services businesses, and community based citizen groups.

2.3 **Promote the Improvement of CFC Related Technical Training**

The Department of the Environment with the cooperation with the Department of Advanced Education and Job Training, and the Nova Scotia Refrigeration Services Engineering Society(RSES), and others should upgrade the curriculum in the refrigeration and air conditioning trades training programs of the Nova Scotia Technical Institute, and all community colleges, such as to provide the appropriate level of knowledge and skills for handling CFCs and pending new CFC related technologies.

The Refrigeration Services Engineering Society should also be encouraged to develop and offer CFC recovery/recycling upgrading courses for existing certified service personnel and should, together with other CFC related industry or trade associations, consider the implementation of WHMIS training programs related to the handling and management of CFCs in the work place.

3.0 Community Based Consumer Awareness Programs

3.1 **Promotion of Citizen Action to Minimize CFC Emissions and Products Use**

Community based organizations, such as Voluntary Planning, local chambers of commerce, and boards of trade, the Ecology Action Centre, and other environmental or citizen interest groups, could be engaged to produce and distribute educational materials directed at urging citizens to reduce CFC emissions or to avoid purchasing CFC

based products. Distribution of such material could be greatly facilitated by using public utility billing mail outs and other such mechanisms

The following are suggested as areas where a series of educational or information materials could be developed by community groups, preferably in partnership with government and industry, for distribution to the public:

i.) avoiding the use of plastic foam packaging;

ii) avoiding the purchase of products packaged as aerosol sprays

iii) avoiding the purchase or use of hand-held Halon fire extinguishers in the home;

iv) avoiding the use of CFC-containing rigid foam products in home construction;

v) avoiding the purchase of cars with air conditioners, and following good maintenance practices where they exist;

vi) promoting responsible maintenance and servicing for home refrigeration appliances and servicing.